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The Grey Mullets

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The grey mullets comprising the family Mugilidae are a common sight in the coastal waters and estuaries of the tropical and subtropical zones of all seas. They are known to ascend frequently into the fresh water zone of rivers. The main food of the mullets restrict them to shallow waters for feeding and presumably explain their abundance in estuaries and lagoons where such food reach their greatest density. Mullets in general are hardy fish, capable of living in extreme conditions of environment. They tolerate wide variation in salinity ranging from that of fresh water to brine water (92‰), and temperature ranging from 3–4°C to 40°C. They are known to survive in oxygen levels as low as 0.5 p.p.m. On account of these properties the grey mullets are probably one of the most important of all salt water fishes for farming in fresh and saline waters. They are extensively cultivated in several countries of the Indo-Pacific region, in Israel and in Egypt to augment the food supplies. Due to their good flavour and high nutritive value, mullets form one of the best table fishes.

In view of their economic importance, the grey mullets of India have been investigated in some detail at the Central Marine Fisheries Research Institute in recent years. Twentyseven species of grey mullets were reported to be occurring in India, but only the following 13 species may be recognised: *Mugil cephalus* Linnaeus, *M. cunnesius* Valenciennes, *Liza macrolepis* (Smith), *L. tade* (Forsk°al), *L. parsia* (Hamilton), *L. carinatus* (Valenciennes) *Valamugil seheli* (Forska°l), *V. buchanani* (Bleeker), *Ellochelon vaigiensis* (Quoy & Gaimard) *Plicomugil labiosus* (Valenciennes), *Crenimugil crenilabis* (Forska°l), *Rhinomugil corsula* (Hamilton) and *Sicamugil cascasia* (Hamilton). Of these the occurrence of the last named species in India is restricted to the upper reaches of the larger river systems of north India, viz., the Ganga, Yamuna, Brahmaputra and Indus, its lower most point on the Ganga river being Patna. However, record for this species in Ceylon mentions that the species "enters rivers" and as such the identity of the same remains to be checked. *R. corsula* is the only species which has its natural distribution in the fresh and brackish waters of the Gangetic and Mahanadi river systems. This species has also been reported to occur in the sea off the Midnapore coast of Bengal where the salinity is low. The average annual catch of mullets from the marine zones of India during 1960–65 was 1409 tonnes which is about 0.2% of the total marine fish landing during the same period. It is possible that a similar amount if not more is caught annually from the estuaries and brackish water lakes in India.

The fishery of the grey mullets around Mandapam in the Palk Bay and the Gulf of Mannar, with particular reference to the biology of *Liza macrolepis* and *Mugil cephalus*, has been studied. These two species along with *L. parsia* are commonly caught in the

shallow marine areas and in the adjacent lagoons. Other species occurring in the area are *L. tade, V. seheli. V. buchanani, M. cunnesius* and *E. vaigiensis.* An average size of 13 cm, 22 cm and 29 cm are attained by *L. macrolepis* at the end of the first, second and third year of its life respectively. Males and females attain sexual maturity at 16 cm and 17 cm respectively. Individual fish spawns once in a season, which extends from June to February with a peak during July and August. Sexes are equally distributed. The fecundity varies between 1,51,920 to 6,76,200 ova. The modal size group of *M. cephalus* progressively increase from about 9—11 cm in January of one year to 25—26 cm in January of the next year thus showing an average increment of about 15 cm during a period of 12 months. An interesting case of shedding the gill raker processes was observed in grey mullets during the present investigations. Mullet shed these tiny processes present in double row in the inner face of the gill rakers into their habitat. These are also taken in by the fish while feeding at the bottom. Such an unusual habit has not hitherto been reported in fishes.

The consensus of opinion on the spawning of salt water mullets, as evidenced by isolated observations, from tagging experiments and from other circumstantial evidences is that normally, they migrate to sea for spawning. However, *M. capito*, a salt water mullet, has been reported to have bred successfully in brackish water in the Lake Qarum (Egypt) while *M. cephalus* has failed to spawn, inspite of gonadal development to maturity in the landlocked Salton Sea of the southern California which has an annual variation in salinity and temperature at 31.4—33,0‰ and 10—36°C respectively. *R. corsula* was reported to be breeding both in the salt water as well as in fresh water habitats. The two well authenticated instances of spawning of *M. cephalus* were at sea in surface but over deep water, 50 and 750 fathoms, in the Black Sea and in the gulf of Mexico respectively. Very small larva of this species were reported from the surface in water more than 100 fathoms and 28 fathoms deep off Kabashima (Japan) and along the south Atlantic coast of the United States of America respectively. *M. cephalus* has been reported to undertake regular breeding migrations from the Chilka Lake to the sea during the months of September to January. Relatively large mature fish migrate away from the lagoon early in the season and progressively smaller ones migrate later as the breeding season advances.

A study of the reported breeding periods of Indian mullets indicate that most species have a protracted breeding period extending from 4 to 10 months. Only *M. cuunesius* and *R. corsula* seem to have a brief breeding period extending from 4 to 5 months. The breeding season of each species, the actual months and the duration involved, appear to vary from region to region, one overlapping with the other in many cases. The composite picture for the breeding season of each species is: *M. cephalus* September to May, *L. macrolepis* June to February, *L. parsia* August to March, *L. tade* May to March, *M. cunnesius* May to August, *V. seheli* May to February, *E. vaigiensis* May to February and *R. corsula* May to September.

Juvenile and adult *L. macrolepis* and *M. cephalus*, as also of other mullets, are essentially bottom feeders subsisting on decayed organic matter supplemented by fresh and decaying plant (algae) and animal matter, which is constituted by the 'biological complex', from what is known as the iliotrophic layer on the substratum of their habitat. Other

items met with in the mullet stomach are sand particles and sponge spicules. While the latter could have been ingested along with the food items, particularly foraminifera, since species of foraminifera are known to build 'houses' with sponge spicules, inclusion of sand seems to be deliberate and is believed to assist in grinding the food in the muscular gizzard-like stomach. The 'biological complex' referred to above is the green scum that develops at the bottom of the shallow water areas and is known to consist essentially of a rich growth of *Phormidium* and *Oscillatoria* and other forms such as *Microcoleus*, *Lyngbya* and *Spirulina* and also harbour a variety of littoral diatoms, desmids, ciliates, rotifers, nematodes, planarians, small annelids, amphipods and a few insect larvae, besides considerable quantities of organic detritus and associated bacterial flora.

The early juvenile of *L. macrolepis*, *L parsia*, *L. tade* and *M. cephalus* and possibly of other species feed on phyto and zooplankton, the particular type of organism ingested being dependent on their availability in the area. In the food of mature and spent *L. macrolepis* a greater proportion of diatoms and copepods have been observed.

The foregoing observations would therefore explain the views put forward by different authors for considering mullets as plankton feeders, omnivores, foul feeders, bottom feeders etc., and indicate the necessity of studying the food habits of fishes in relation to size and maturity stages.

While the early juveniles are mostly found close to surface, juveniles and adults in the trophic phase are seen to move at the bottom at an angle of about 45° to it, and mature and spent adults again are found close to surface. Where two or more species of mullet occur in the same natural environment there appear to be some sort of species-wise segregation. Adult mullet in the trophic phase tend to be scattered or in small schools of a few individuals. Younger fish tend to be aggregated in schools of moderate size, which tend to congregate into larger schools as maturity and the spawing migration approach. Mullet in the spawning run move close to surface. Their movements could be recognised by the dark patch and the characteristic ripples they cause on the surface. Employment of suitable fishing gear for mullets keeping in view these differential distribution patterns of fish in the different phases of life would certainly yield a better catch.

In India nets specially meant for catching mullets are devised with regard to their peculiar habits. They are known to ascend in schools to the shallow littoral areas and connected creeks and channels with the high tide for feeding purposes. Such schools when scared, leap and rush in their effort to escape. Mullets are caught mainly in the gill nets, *Mangan jal* and *Khanderi jal* in the gulf of Kutch and gulf of Cambay, *Kendai valai* in the Coromandel coast *Khainga jalo* or *Nolijalo* and *Menjia jalo* in the Chilka Lake; in the cast nets, *Pag* in Konkan area, *Shendi* in North Kanara; *Veechu valai* in the Coromandel coast and *Kapla jal* in Bengal; in the dip nets, in Kanara and Kerala, *Hela jal*, *Kharra jal* and *Khorsula jal* in Bengal; in the stake nets or barrier nets, *Jadi jal* in the gulf of Cambay *Valu valai* and *Waghur* in Kanara and Kerala, *Kalamkattivalai* in the Palk Bay and the Gulf of Mannar *Kala valai* and *Kattu valai* in the Coromandel coast, *Jano* in the Chilka

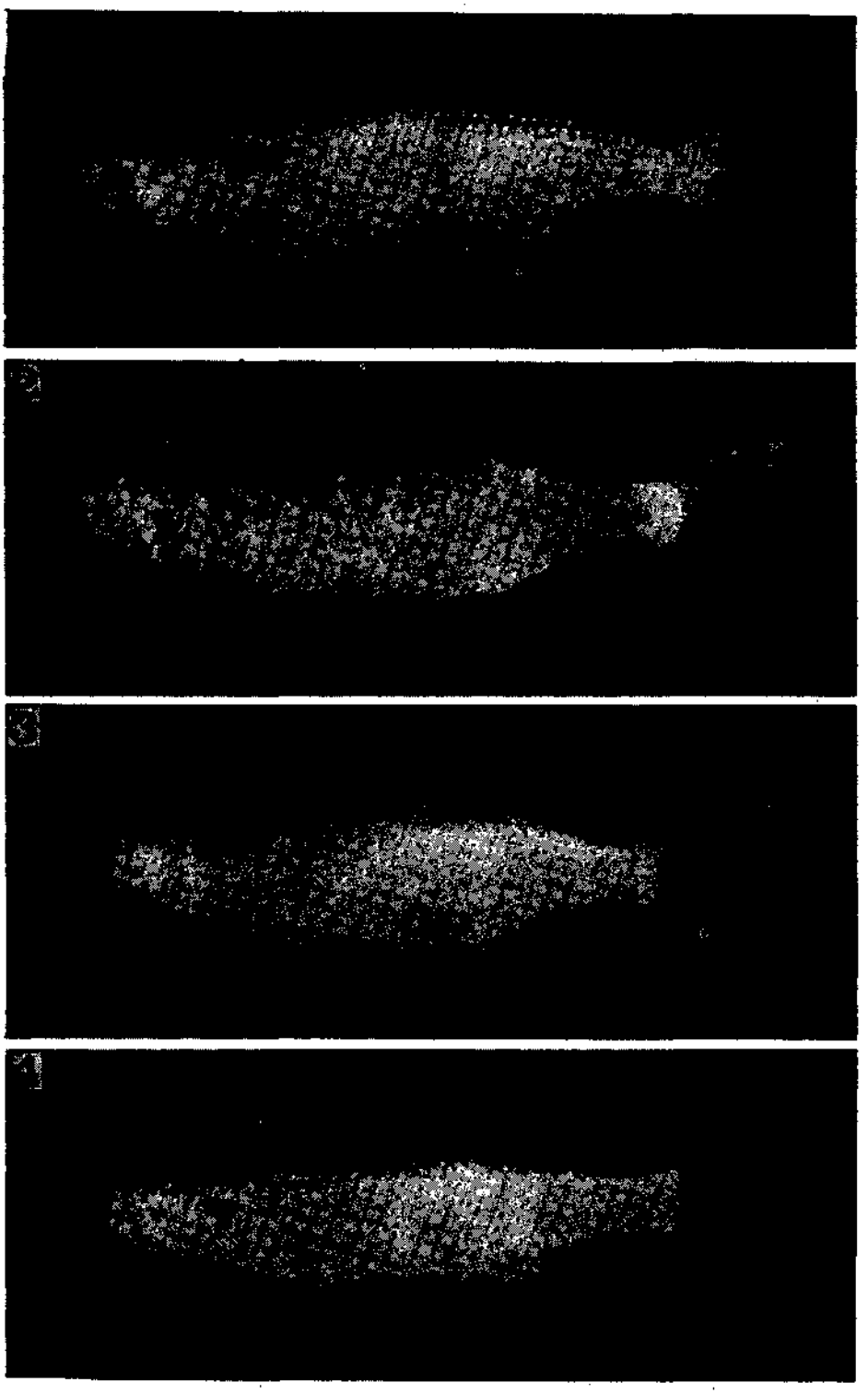

PLATE I.
1. *Mugil cephalus* Linnaeus
2. *Mugil cunnesius* Valenciennes
3. *Liza parsia* (Hamilton)
4. *Liza tade* (Forskal)

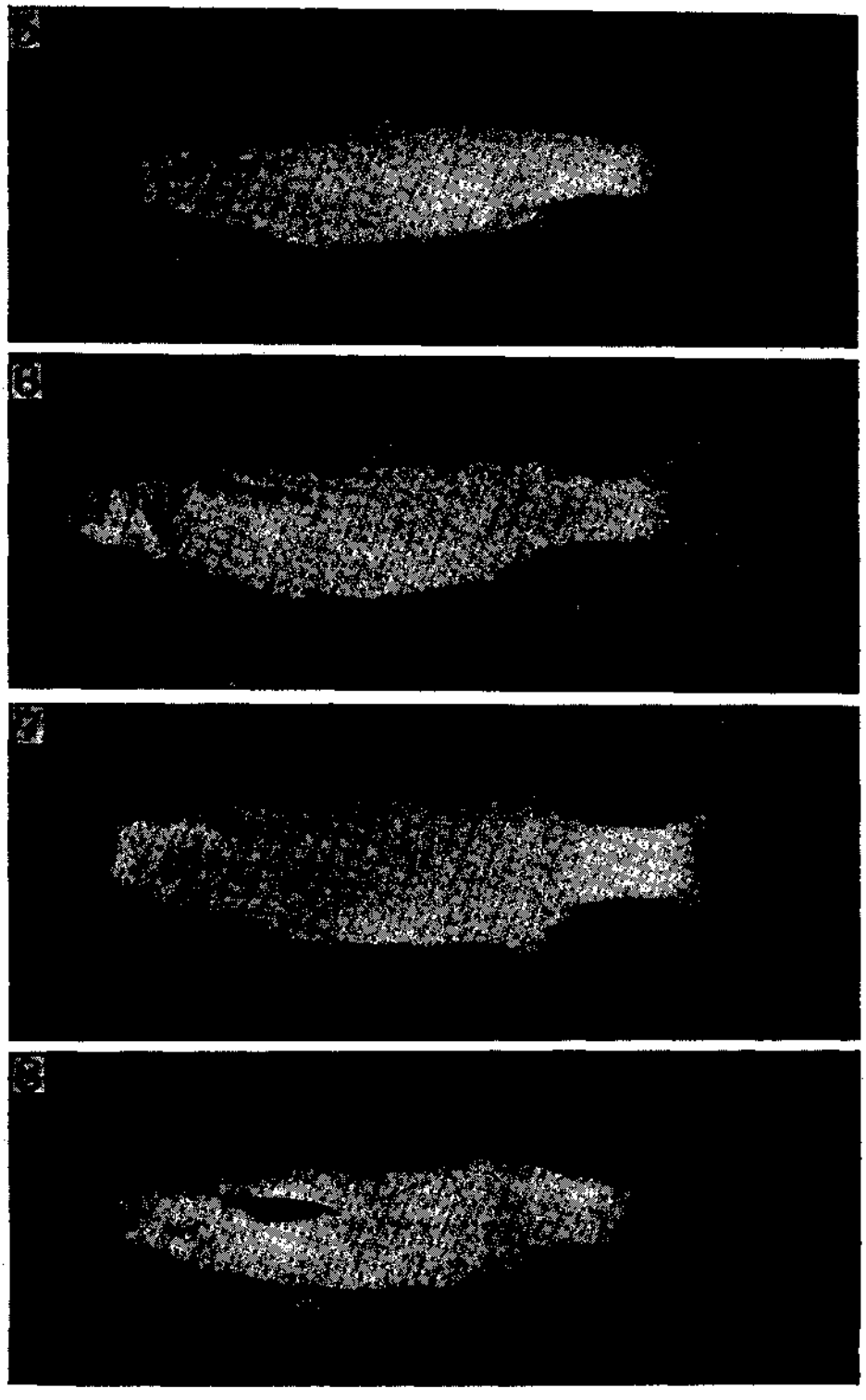

PLATE II. 5. *Liza macrolepis* (Smith)
6. *Valamugil seheli* (Forskal)
7. *Valamugil buchanani* (Bleeker)
8. *Ellochelon vaigiensis* (Quoy & Gaimard)

Lake, and *Char-gherra jal Bher jal, Charhatta jal* and *Komar jal* in Bengal; and in the pouch nets, *Ghalwa* in the Gulf of Cambay and *Vidu valai* in Palk Bay and the Gulf of Mannar, and *Iriga valai* iu the Coromandel coast. The last mentioned net is specially adapted to catch mullet in the spawning run.

Fishing for mullets takes place in the estuaries and coastal inlets at all times of the year. A study of the size composition of the mullet catches reveals that in India their fishery is based mainly on immature fish. However, the formation of migratory schools before spawning is taken advantage of in several areas to obtain increased catches. Mullets are of considerable commercial importance in the fisheries of the Mediterranean, Black sea, Florida, Gulf of Mexico, Gulf of California, Southeast coast of Japan, Philippines, the northern shores of China, South Africa and southern Australia. In India the principal regions supporting mullet fishery are the estuaries of the rivers Ganga, Mahanadi, Godavari Krishna and Cauvery, and the brackish water lakes of Chilka and Pulicat on the east coast, the estuaries of the Narbada and Tapti, the Gulf of Kutch and the backwaters of Kerala on the West coast, and the innumerable shallow bays and creeks in the Andaman group of Islands.

Although different species of mullets have been reported to be occurring in the fisheries of the different areas in India, *Mugil cephalus, L. macrolepis, L. parsia* and *L. tade* may be considered as the important species from the fishery point of view. East coast of India produces larger quantity of mullets compared to the west coast. The Chilka Lake, the largest brackish water lake in India, being about 400 sq. miles in extent, produces an annual mullet catch of about 600 tonnes, which is nearly 17% of the total fish production (about 3535 tonnes) of the Lake. Fishing for mullets is done almost throughout the year, best catches being available during October-March. A flourishing trade for small cured mullet roe was reported to have existed in the area prior to World War II. The Mahanadi estuary produces annually a mullet catch of about 230 tonnes, constituting nearly 38% of its total fish production. Fishing for mullets is done throughout the year, best catches being available during November-January. Mullets contribute to about 1% of the total annual catch of about 5750 tonnes in the Hooghly and Matlah estuaries. In the Godavari estuary mullets form about 4% of the total annual catch of about 300 tonnes. In the Pulicat Lake mullets constitute about 30% of the total annual fish catch of about 850 tonnes.

Mullets lend themselves well for culture purposes. The fry of salt water mullets can be collected from almost all estuaries; particularly the shallow marginal areas of rivers, tidal streams, creeks, swamps and inundated fields are ideal spots for their collection. They are more abundant in these areas 4–6 days after the full and new moon. The peak abundance of the different species in the different zones depends on the peak breeding season of the species concerned. Mullet fry collected from sea and the creeks when directly stocked in fresh water ponds do not show appreciable mortality. However, the general opinion is that

acclimation and conditioning are desirable before transporting and stocking them in ponds. Mortality during acclimation can be minimised by feeding the fish during the process.

Profitable fish culture aims at the production of maximum quantity of edible fish flesh by employing rapidly growing fish capable of shortening the food chain and converting decaying organic matter or the next link in the food chain, namely, algae effectively into edible fish flesh. These conditions are fulfilled to some extent by the herbivorous and detritus feeders like the grey mullets, etc. Among the salt water mullets, *M. cephalus*, *L. parsia*, *L. tade*, *M. cunnesius*, *L. macrolepis*, *V. seheli*, *V. buchanani* and *E. vaigiensis* are species highly suited for cultivation (Plates I&II). The first three species have been reported to be extensively in use in the Indo-Western Pacific region for culturing in brackish and fresh water ponds along with the milk fish, *Chanos chanos* and other species. In brackish water ponds, *M. cephalus* has been reported to attain a size increment of 29 cm during a period of six months while its average growth rate in natural environment is about 14 and 24 cm only at the end of the first and second year respectively; *L. parsia* attains a size of 15 to 19 cm at the end of first year while it is known to grow to about 10 cm only in natural environment; *L. tade* attains a size of 24 to 25 cm at the end of first year and 34 to 36 cm at the end of second year while it is known to grow in natural environment to about 17 and 25 cm at the end of the first and second year respectively. It is therefore obvious that grey mullets cultivated in ponds grow faster than those in natural environment; this coupled with their hardy nature and food preference, rank them high as a primary group in mixed fish culture.